

Renaissance of Minilaparoscopy in the NOTES and Single Port Era

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“Simplicity is a difficult thing to achieve.”
Charlie Chaplin

INTRODUCTION

Surgery, the oldest and most traditional medical practice, struggles to keep its identity. Several new technologies appear eager to hold the title as a major breakthrough, which belongs to laparoscopic surgery. Whether we need a change in the practice of surgery has never been questioned as surgeons try to achieve the Holy Grail of “scarless surgery.”¹

Not every great product becomes a blockbuster. Not every new technology, as promising as it may be, will be used on a large scale. Some features are critical to the success of a new technology over the competitive already established ones. Surgeons are but consumers in this rapidly changing world, deciding which new technology/technique they will adopt: NOTES (Natural Orifice Transluminal Endoscopic Surgery), LESS (Laparo- Endoscopic Single Site Surgery), or Minilaparoscopy. A general availability with few access limitations, easy applicability with a short learning curve and a superior benefit to cost ratio ensures whether a technique survives for posterity. Lastly, without direct and substantial benefit to the patient, any new technique or technology would ultimately be consigned to the flames of history. The final arbiter obviously is the end consumer the patient for whose benefit all this is explored.

NOTES, Natural Orifice Transluminal Endoscopic Surgery, a term coined by a multidisciplinary consortium of

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Gastroenterologists and Surgeons denotes a surgery that uses natural orifices for a new access site. A “scarless” (at least for the skin) surgical technique NOTES has become feasible as a result of a huge effort and investment of the surgical and medical community along with industry. NOTES is technically feasible if performed within an almost unreal environment, using sterilized endoscopes by at least 2 specialists, 1 surgeon/1 highly skilled endoscopist working together (really fantastic!), and on motivated and intrepid patients. Unfortunately, NOTES is far from a reality in most centers. Furthermore, NOTES has problems with access. The vaginal route excludes many of our population save multiparous women. The gastric and rectal routes of entry defy logic by perforating normal organs to get at pathological ones.¹

This “utopic” environment has become a reality in a few major centers around the world, but certainly the vast majority of surgeons will not have access to this fantastic world in the near future. Nobody questions the incorporation of technology in our daily lives, but financial constraints have caused the of downfall of many projects, regardless of their potential and initial promise. Undoubtedly NOTES has at least favored the revival of philosophical concepts in new areas of access long forgotten, and has also urged the need to reinvent laparoscopy and endoscopy.

From natural orifices, we move towards natural scars. Surgeries are performed with only one access at the umbilicus. It is amazing why no one has thought of this before. The concept of violating our only original scar has a strong appeal, even as it remains the best gateway to laparoscopy itself. Questions do, however, arise, when turning this portal into a large gate, large enough to insert a single access device port for multiple instruments or, in the case of the “Single Incision Multi-Port” technique, many small ports one on the side of each other. Strongly pushed by industry, the concept of a single port or single incision surgery still needs to define its role. Meanwhile, literature abounds with case studies and series, some of them questionable, such as appendectomy, inguinal hernia repair, and perhaps even cholecystectomy.^{1,2} However as a technique for

the surgical removal of solid organs or larger specimens, such as for nephrectomy, splenectomy or colectomy, this new concept may prove its value.³ If one goes through most of these series and reports, one finds that when in trouble or difficulty, the single port procedure is “rescued” by addition of needles or minilaparoscopic instruments to facilitate dissection or to obtain proper triangulation for intracorporeal suturing.⁴

In that case, one might be tempted to say that Minilaparoscopy (MINI) in this context has really come to stay. This is the same MINI Michel Gagner and Peter Goh described in the 90s,^{5,6} which did not become popular because it was complicated and the instruments deemed too flimsy. It was unpopular because surgeons used very thin, fragile, and expensive scopes. Moreover, surgeons insisted on clipping every structure from the umbilical port, which resulted in changing the scope several times in a single procedure, making MINI not only complicated but also time consuming.⁷ Stigmatized as an expensive and complicated surgery, at that time MINI seemed to have no major advantages and did not progress as industry had imagined.

However, MINI had not been entirely abandoned and continued to be practiced in several centers around the world,⁸⁻¹¹ including ours in Recife, Brazil. From the State University of Pernambuco emerged a variant technique for MINI that made it possible to execute minilaparoscopy easily adapted to our conditions and the reality of the day. This adaptation, that we call “Clipless,” was however carefully designed, tested, and gradually implemented.¹² Taking as an example the cholecystectomy, we have been performing this technique of Clipless cholecystectomy since 2000 by using a standard 10-mm scope, placed at the umbilical port. The cystic duct is ligated with simple knots, and the cystic artery is carefully cauterized according to rigid standard principles. After 10 years experience and over 1,300 MINI Clipless cholecystectomies,¹³ our group can undoubtedly confirm the safety of our procedure and reassure skeptics who may consider cauterization of the cystic artery a true sacrilege. Currently, MINI Clipless is a 1-day surgery, safe, with all the advantages of laparoscopy, highly reproducible, cost effective, and with great aesthetic appeal.³

With strong beliefs that MINI Clipless was really a better choice, the Curitiba group at Positivo University started their experience with MINI 3 years ago, first performing cholecystectomies and appendectomies, then totally extraperitoneal inguinal hernia repairs and finally lumbar sympathectomies for hyperhidrosis. For the advanced

procedures, they noticed that their surgeries were being performed with more precise movements, mostly in significantly less time, and obviously superior aesthetics compared to standard laparoscopy. They also noticed that MINI Clipless was easily learned and incorporated into surgical practice (in general, performing 10 cholecystectomies is sufficient to feel comfortable with the technique).

In endoscopic surgery, peripheral vision is limited by the visual field of the laparoscope. In this tunnel vision, thinner instruments occupy less space, and a much better view can be obtained. Mini instruments fit well into the concept of amplified vision provided by laparoscopes. The increase in vision scale seen in laparoscopy does not find a perfect partnership with conventional 5-mm instruments, and they become a coarse instrument for dealing with more delicate situations, such as biliary anastomosis, resection of a sympathetic ganglion adherent to the vena cava, or dissection of the deferens duct from the hernia sac during hernia surgery. This is especially important in retroperitoneal surgeries, where the space is naturally restricted and inadvertent movements may result in peritoneal perforations thus causing gas escape and further space reduction. More delicate surgeries should be preferably done by minilaparoscopy.

Unlike other new access methods such as NOTES and single-port, MINI reigns for its simplicity, offering increased dexterity, delicacy, and precision, without significantly adding extra costs and at the same time, maintains the triangulation that is deemed essential in standard laparoscopy. Surgical precision has always been important. A significant question is whether one should risk losing this for the sake of cosmesis.

Current Mini trocars, unlike their ancestors from the 90s, do not have a sealing membrane (“No rubber gaskets”). They have very low friction therefore almost no force is needed to move the instruments inside the trocars.¹⁴ The resultant increase in CO₂ leak, formerly regarded as a reason for criticism and without any real consequence in the performance of the procedure, is being successfully corrected by these new trocar models. Current technical limitations of MINI are being resolved by the efforts of the industry in crafting more resistant and higher performance instruments. MINI instruments are more delicate and need more repair when compared to 5-mm laparoscopy instruments.

Returning to the age-old debate of surgical access. Single/larger or multiple/smaller access, which is better? It re-

sembles reviving an old quarrel between traditional laparoscopy and open surgery. When using theoretical mathematic models for measuring the volume of parietal injury and parietal incision tension for comparing MINI and single port, minilaparoscopy stands out, because it uses various diminutive accesses. Consequently, the potential benefits of MINI would be less volume of parietal injury, less total area of tension at the incision and less somatic pain.^{15,16} At the present time, Mini instruments are the only ubiquitous instruments that can be used in all current endoscopic techniques, including NOTES and single port hybrid techniques. Many hybrid techniques are indeed minilaparoscopy assisted by single port or NOTES.¹⁷ We should not forget that actually the majority of NOTES procedures currently done in humans are also hybrid,¹⁸ and several of them are done using Mini instruments.

New concepts are fundamental for the development of surgery, and sometimes they are used in new applications in different areas from where they were originally planned. The average surgeon has never seen so many options of new access techniques appearing in such a short period of time. However, for this surgeon, shaped in a harsh professional reality and concerned with improving the quality of his daily professional activities, the first step towards the natural evolution of laparoscopy seems to be the refinement of the technique he already uses. This would be achieved by “simply” reducing the thickness of his instruments, therefore allowing increments in precision and almost invisible MINI incisions. Although evidence has shown that the practice of MINI requires training and dexterity, it is the simplest, most logical, cost-effective, least glamorous, and therefore, most attractive evolution for the time being.

We should not forget Leonardo da Vinci’s quote: “Simplicity is the ultimate sophistication.” We would dare to say that because of its simplicity, MINI could be considered the most sophisticated evolution of laparoscopic surgery.

We conclude that the classical laparoscopic technique, based on proper triangulation, is less likely to be supplanted in the near future, considering the overall sum of our 3 initial items.

We eagerly await the development of new instruments and future technology that will likely evolve from the fusion of single port and NOTES, possibly associated with robotics and computer-assisted procedures.¹⁹ This future technology will eventually be the standard for our surgical procedures avoiding the use of conventional instruments

inappropriately borrowed from laparoscopy and flexible endoscopy. At the present time, in our universe of multiple technical options, the best approach is to consider the quality of care and the safety of our patients as our first priority, above all other interests.

References:

1. Rao PP, Rao PP, Bhagwat S. Single-incision laparoscopic surgery-current status and controversies. *J Minim Access Surg.* 2011;7(1):6-16.
2. Rivas H, Varela E, Scott D. Single-incision laparoscopic cholecystectomy: Initial evaluation of a large series of patients. *Surg Endosc.* 2010;24:1403-1412.
3. Bucher P, Pugin F, Morel P. Single-port access laparoscopic radical left colectomy in humans. *Dis Colon Rectum.* 2009;52:1797-1801.
4. Desai MM, Stein R, Rao P, et al. Embryonic natural orifice transumbilical endoscopic surgery (E-NOTES) for advanced reconstruction: Initial experience. *Urology.* 2009;73:182-187.
5. Gagner M, Garcia-Ruiz A. Technical aspects of minimally invasive abdominal surgery performed with needlescopic instruments. *Surg Laparosc Endosc.* 1998;8(3):171-179.
6. Cheah WK, Goh P, Gagner M, So J. Needlescopic retrograde cholecystectomy. *Surg Laparosc Endosc.* 1998;8(3):237-238.
7. Lai EC, Fok M, Chan AS. Needlescopic cholecystectomy: prospective study of 150 patients. *Hong Kong Med J.* 2003;9(4):238-242.
8. Mostafa G, Matthews BD, Sing RF, Kercher KW, Heniford BT. Mini-laparoscopic versus laparoscopic approach to appendectomy. *BMC Surg.* 2001;1:4.
9. Mamazza J, Schlachta CM, Seshadri PA, Cadeddu MO, Poulin EC. Needlescopic surgery. A logical evolution from conventional laparoscopic surgery. *Surg Endosc.* 2001;15(10):1208-1212.
10. Lee PC, Lai IR, Yu SC. Minilaparoscopic (needlescopic) cholecystectomy: a study of 1,011 cases. *Surg Endosc.* 2004;18(10):1480-1484.
11. Franklin ME Jr., George J, Russek K. Needlescopic cholecystectomy. *Surg Technol Int.* 2010;20:109-113.
12. Carvalho GL, Silva FW, Silva JS, et al. Needlescopic clipless cholecystectomy as an efficient, safe, and cost-effective alternative with diminutive scars: the first 1000 cases. *Surg Laparosc Endosc Percutan Tech.* 2009 Oct;19(5):368-372.
13. Carvalho GL, Chaves EFC, Gouveia RLP, et al. Cystic artery Electrocauterization as an efficient, safe and cost-effective alternative in the minilaparoscopic cholecystectomy. Article submitted to Society of American Gastrointestinal and Endoscopic Surgeons Congress (SAGES), 2011, Abstract P379. Epub 2010 Feb 14.

14. Carvalho GL, Lima DL, Sales AC, Silva JSN, Fernandes Junior FAM. A new very low friction trocar to increase surgical precision and improve aesthetics in minilaparoscopy. Article submitted to Society of American Gastrointestinal and Endoscopic Surgeons Congress (SAGES), 2011, Abstract ETP077.
15. Blinman T. Incisions do not simply sum. *Surg Endosc.* 2010 Jul;24(7):1746-1751. Epub 2010 Jan 7.
16. Carvalho GL, Cavazzola LT. Can mathematic formulas help us with our patients? *Surg Endosc.* 2011 Jan;25(1):336-337.
17. Weibl P, Klingler HC, Klatter T, Remzi M. Current limitations and perspectives in single port surgery: pros and cons Laparo-Endoscopic Single-Site Surgery (LESS) for renal surgery. *Diagn Ther Endosc.* 2010;2010:759431.
18. Teoh AY, Chiu PW, Ng EK. Current developments in natural orifices transluminal endoscopic surgery: an evidence-based review. *World J Gastroenterol.* 2010 Oct 14;16(38):4792-9.
19. Dhumane PW, Diana M, Leroy J, Marescaux J. Minimally invasive single-site surgery for the digestive system: A technological review. *J Minim Access Surg.* 2011 Jan;7(1):40-51.